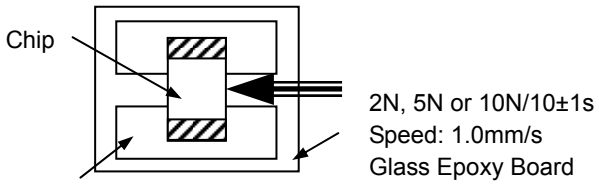
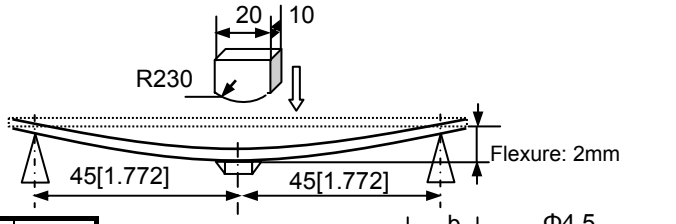
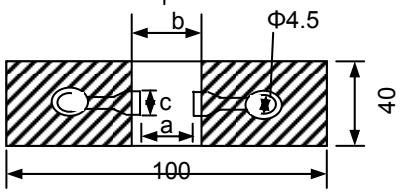
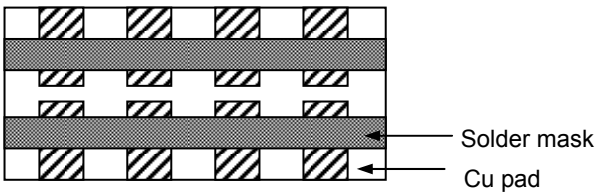
RELIABILITY AND TEST CONDITIONS

Chip NTC Thermistor (SDNT Series)

<table>
<tr><th>Items</th><th>Requirements</th><th>Test Methods and Remarks</th></tr>
<tr><td>1. Operating Temperature Range</td><td colspan="2">-55℃ to +125℃</td></tr>
<tr><td>2. Storage Temperature Range</td><td colspan="2">-55℃ to +125℃</td></tr>
<tr><td>3. Terminal Strength</td><td>No removal or split of the termination or other defects shall occur.</td><td>① Solder the chip to the testing jig (glass epoxy board shown as the following figure) using eutectic solder. Then apply a force in the direction of the arrow.
② 2N force for 0603 series.
③ 5N force for 1005 and 1608 series
④ 10N force for 2012 series
⑤ Keep time:10±1s
  </td></tr>
<tr><td>4. Resistance to Flexure</td><td>No visible mechanical damage.</td><td>① Solder the chip to the test jig (glass epoxy board) using a eutectic solder. Then apply a force in the direction shown as the following figure.
② Flexure: 2mm
③ Pressurizing Speed: 0.5mm/sec
④ Keep time: 30 sec
Unit: mm [inch]
 
 
<table><tr><th>Type</th><th>a</th><th>b</th><th>c</th></tr><tr><td>0603[0201]</td><td>0.25</td><td>0.8</td><td>0.3</td></tr><tr><td>1005[0402]</td><td>0.4</td><td>1.5</td><td>0.5</td></tr><tr><td>1608[0603]</td><td>1.0</td><td>3.0</td><td>1.2</td></tr><tr><td>2012[0805]</td><td>1.2</td><td>4.0</td><td>1.65</td></tr></table></td></tr>
<tr><td>5. Vibration</td><td>No visible mechanical damage.</td><td>① Solder the chip to the testing jig (glass epoxy board shown as the following figure) using eutectic solder.
② The chip shall be subjected to a simple harmonic motion having total amplitude of 1.5 mm, the frequency being varied uniformly between the approximate limits of 10 and 55 Hz.
③ The frequency range from 10 to 55 Hz and return to 10 Hz shall be traversed in approximately 1 minute. This motion shall be applied for a period of 2 hours in each 3mutually perpendicular directions (total of 6 hours).
  </td></tr>
<tr><td>6. Dropping</td><td>No visible mechanical damage.</td><td>Drop the chip 10 times on a concrete floor from a height of 100 cm.</td></tr>
</table>

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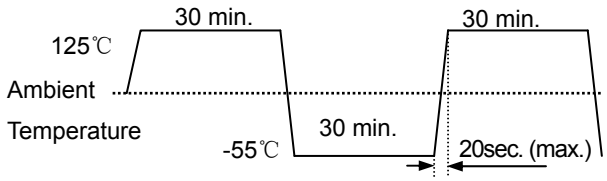
RELIABILITY AND TEST CONDITIONS

Chip NTC Thermistor (SDNT Series)

Items	Requirements	Test Methods and Remarks
7. Solderability	① No visible mechanical damage. ② Wetting shall be exceeded 80% coverage.	① Solder temperature: 240±2℃ ② Duration: 3 sec ③ Solder: Sn/3.0Ag/0.5Cu ④ Flux: 25% Resin and 75% ethanol in weight
8. Resistance to Soldering Heat	① No visible mechanical damage. ② R25 change: Within ±5%.*1 ③ B constant change: Within ±2%.*2	① Solder temperature: 260±3℃ ② Duration: 5 sec ③ Solder: Sn/3.0Ag/0.5Cu ④ Flux: 25% Resin and 75% ethanol in weight ⑤ The chip shall be stabilized at normal condition for 1~2 hours before measuring.
9. Thermal Shock	① No visible mechanical damage. ② R25 change: Within ±5%.*1 ③ B constant change: Within ±2%.*2	① Temperature and time: -55℃ for 30±3 min→125℃ for 30±3min ② Transforming interval: 20 sec. Max. ③ Tested cycle: 100 cycles ④ The chip shall be stabilized at normal condition for 1~2 hours before measuring. 
10. Resistance to Low Temperature	① No visible mechanical damage. ② R25 change: Within ±5%.*1 ③ B constant change: Within ±2%.*2	① Temperature: -55±2℃ ② Duration: 1000^{+24} hours ③ The chip shall be stabilized at normal condition for 1~2 hours before measuring.
11. Damp Heat (Steady States)	① No visible mechanical damage. ② R25 change: Within ±5%.*1 ③ B constant change: Within ±2%.*2	① Temperature: 60±2 ℃ ② Humidity: 90% to 95% RH ③ Duration: 1000^{+24} hours ④ The chip shall be stabilized at normal condition for 1~2 hours before measuring.
12. Resistance to High Temperature	① No visible mechanical damage. ② R25 change: Within ±5%.*1 ③ B constant change: Within ±2%.*2	① Temperature: 125±2℃ ② Humidity: 90% to 95% RH ③ Duration: 1000^{+24} hours ④ The chip shall be stabilized at normal condition for 1~2 hours before measuring.
13. Loading at High Temperature (Life Test)	① No visible mechanical damage. ② R25 change: Within ±5%.*1 ③ B constant change: Within ±2%.*2	① Temperature: 85±2℃ ② Duration: 1000^{+24} hours. ③ Applied current: Max. Permissive Operating Current. ④ The chip shall be stabilized at normal condition for 1~2 hours before measuring.

※*1: For F and H tolerance code, the change of R25 should be within ±1% and ±3% respectively. For others, the change of R25 should be within ±5%.

※*2: For F code tolerance, the change of B constant should be within ±1%. For others, the change of B constant should be within ±2%.

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RELIABILITY AND TEST CONDITIONS

Power NTC Thermistor (SPNL Series)

<table>
<tr><th>Characteristics</th><th>Requirements</th><th>Test Methods</th></tr>
<tr><td>1.Robustness of Terminations (Tensile)</td><td rowspan="3">No outstanding damage</td><td>After gradually applying the force specified below and keeping the unit fixed for the seconds, the terminal shall be visually examined for any damage.

<table><tr><td>Terminal diameter</td><td>Force</td></tr><tr><td>Ø 0.6 mm</td><td>9.8 N（1.0Kgf）</td></tr><tr><td>Ø 0.8 mm</td><td>9.8 N（1.0Kgf）</td></tr><tr><td>Ø 1.0 mm</td><td>19.6 N（2.0Kgf）</td></tr></table></td></tr>
<tr><td>2.Robustness of Terminations (Bending)</td><td>The unit shall be secured with its terminal kept vertical and the force specified below be applied in the axial direction.
The terminal shall gradually be bent by 90° in one direction, then 90°in the opposite direction, and again back to the original position.<table><tr><td>Terminal diameter</td><td>Force</td></tr><tr><td>Ø 0.6 mm</td><td>4.9 N（0.5Kgf）</td></tr><tr><td>Ø 0.8 mm</td><td>4.9 N（0.5Kgf）</td></tr><tr><td>Ø 1.0 mm</td><td>9.8 N（1.0Kgf）</td></tr></table></td></tr>
<tr><td>3.Vibration</td><td>After repeat applying a single harmonic vibration (amplitude: 0.75 mm) double amplitude:1.5mm with 1 minute vibration frequency cycles (10Hz to 55Hz to10Hz) to each of three perpendicular directions for 2 hours. Thereafter, the unit shall be visually examined.</td></tr>
<tr><td>4.Solderability</td><td>Approximately 95% of the terminals shall be covered with solder uniformly</td><td>After dipping the terminals to a depth of approximately 3mm from the body in a soldering bath of 235±5℃ for 2±0.5 seconds, the terminal shall be visually examined.</td></tr>
<tr><td>5.Resistance to Soldering Heat</td><td>△R25/R25≦±10%
No outstanding damage</td><td>After each lead shall be dipped into a solder bath having a temperature 260±5℃,to a point 2.0 to 2.5 mm from the body of the unit, using shielding board (t=1.5mm), be held there for specified time (5 series: 5±1s and others: 10±1s), and then be stored at room temperature and humidity for 1 to 2 hours. The change of R25 and mechanical damages are examined.</td></tr>
<tr><td>6.High Temperature Storage/Dry Heat</td><td>△R25/R25≦±20%
No outstanding damage</td><td>The specimen shall be subjected to Max. operating temperature Tu±5℃ for 1000 hours in a thermostatic bath without load and then stored at room temperature and humidity for 1 to 2 hours. Thereafter, the change of R25 shall be measured.</td></tr>
<tr><td>7.Damp Heat/ Humidity (Steady State)</td><td>△R25/R25≦±20%
No outstanding damage</td><td>The specimen shall be subjected to 40±2℃, 90 to 95 %RH for 1000 hours without load and then stored at room temperature and humidity for one to two hours. Thereafter, the change of R25 shall be measured.</td></tr>
<tr><td>8.Temperature Cycle</td><td>△R25/R25≦±20%
No outstanding damage</td><td>The temperature cycle shown below shall be repeated five times and then stored at room temperature and humidity for one to two hours. The change of R25 and mechanical damage shall be examined.<table><tr><td>Step</td><td>Temperature(℃)</td><td>Period (minutes)</td></tr><tr><td>1</td><td>T_L±3</td><td>30±3</td></tr><tr><td>2</td><td>Room temperature</td><td>5±3</td></tr><tr><td>3</td><td>Tu±3</td><td>30±3</td></tr><tr><td>4</td><td>Room temperature</td><td>5±3</td></tr></table></td></tr>
<tr><td>9.Life Test</td><td>△R25/R25≦±20%
No outstanding damage</td><td>After being continuously applied the Permissible Max. Steady current at 25±5℃ for 1000 hours. The specimen shall be stored at room temperature and humidity for one to two hours Thereafter, the change of R25 shall be measured.</td></tr>
</table>

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RELIABILITY AND TEST CONDITIONS

Power NTC Thermistor (SPNL Series)

Characteristics	Requirements	Test Methods
10.Endurance	△R25/R25≦±20% No outstanding damage	After being continuously applied the Permissible Max. Steady current and Permissible Max. Capacitor C_T of $240V_{AC}$ power source at 25±5℃, and the power source 1min ON /5min OFF for 1000 cycles. The specimen shall be stored at room temperature and humidity for one to two hours Thereafter, the change of R25 shall be measured.
11.Insulation Resistance	≥500MΩ No outstanding damage	The specified voltage $1000V_{DC}$ 1min shall be applied both terminals of the specimen connected together and metal foil closely wrapped round its body for 1 minute. Electrical breakdown shall be examined.

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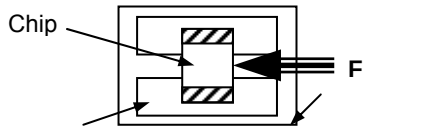
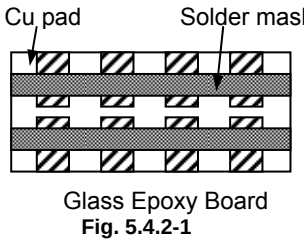
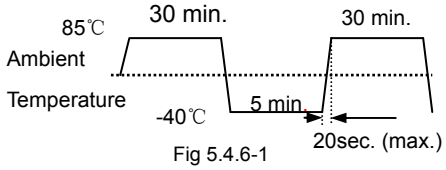
RELIABILITY AND TEST CONDITIONS

Chip Polymer PTC Thermistor (SPP Series)

Items	Requirements	Test Methods and Remarks
5.4.1. Terminal Strength	No removal or split of the termination or other defects shall occur.  **Fig.5.4.1-1**	① Solder the chip to the testing jig (glass epoxy board shown in **Fig.5.4.1-1**) using eutectic solder. Then apply a force in the direction of the arrow. ② 10N force for SPP3216、3225、4532 and 7550 series, ③ 5N force for SPP1608 and 2012 series, ④ Keep time: 10±1s.
5.4.2 Vibration	No visible mechanical damage.  **Fig. 5.4.2-1**	① Solder the chip to the testing jig (glass epoxy board shown in **Fig.5.4.3-1**) using eutectic solder. ② The chip shall be subjected to a simple harmonic motion having total amplitude of 1.5mm, the frequency being varied uniformly between the approximate limits of 10 and 55 Hz. ③ The frequency range from 10 to 55 Hz and return to 10 Hz shall be traversed in approximately 1 minute. This motion shall be applied for a period of 2 hours in each 3mutually perpendicular directions (total of 6 hours).
5.4.3 Solderability	① No visible mechanical damage. ② Wetting shall exceed 90% coverage.	① Solder temperature: 245±5℃ ② Duration: 5 sec. ③ Solder: Sn/3.0Ag/0.5Cu. ④ Flux: 25% Resin and 75% ethanol in weight. ⑤ The chip shall be stabilized at normal condition for 24±4 hours before measuring.
5.4.4 Thermal Shock	① No visible mechanical damage. ② ±10% typical resistance change  Fig 5.4.6-1	① Temperature, Time: -40℃for 30±3 min→85℃ for 30±3min. ② Transforming interval: 20sec. (max.) ③ Tested cycle: 20 cycles. ④ The chip shall be stabilized at 25℃ for 24±4 hours before measuring.
5.4.5 Resistance to Low Temperature	① No visible mechanical damage. ③ ±5% typical resistance change	① Temperature: -40±2℃ ② Duration: 1000^{+24} hours. ③ The chip shall be stabilized at 25℃ for 24±4 hours before measuring.
5.4.6 Resistance to High Temperature	① No visible mechanical damage. ② ±5% typical resistance change	① Temperature: 85±2℃. ② Duration: 1000^{+24} hours. ③ The chip shall be stabilized at 25℃ for 24±4 hours before measuring.
5.4.7 Damp Heat (Steady States)	① No visible mechanical damage. ② ±5% typical resistance change	① Temperature: 85±2℃ ② Humidity: 80% to 85% RH. ③ Duration: 1000^{+24} hours. ④ The chip shall be stabilized at normal condition for 24±4 hours before measuring.
5.4.8 Cycle Life	① No visible mechanical damage.	④ Temperature:25±2℃ ⑤ Applying tne maximun working current of Imax and maximum working voltage of Vmax, 6Sec power on, 120 Sec power off to PPTC elements, circulation 100 times

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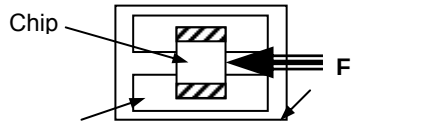
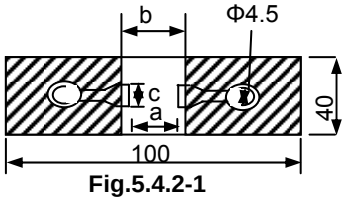
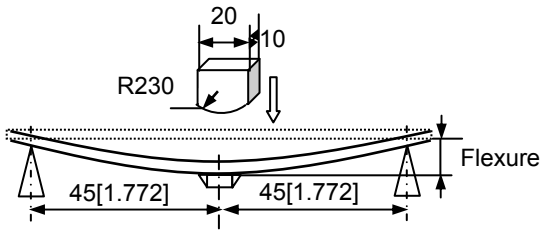
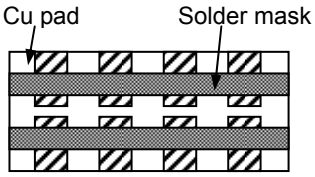
RELIABILITY AND TEST CONDITIONS

Chip Ceramic PTC Thermistor (SCP Series)

Items	Requirements	Test Methods and Remarks
5.4.1 Withstanding Voltage	Without damage	Applying 120% of the maximum operating voltage to PTC by raising gradually for 180±5 secs,at 25℃. (A protective resistor is to be connected in series, and the inrush current through PTC must be limited below maximum rated value.)
5.4.2 Terminal Strength	No removal or split of the termination or other defects shall occur.  **Fig.5.4.1-1**	① Solder the chip to the testing jig (glass epoxy board shown in the following **Fig.5.4.1-1**) using eutectic solder. Then apply a force in the direction of the arrow. ② 5N force for SCP1608 series 10N force for SCP2012 series ③ Keep time: 10±1s
5.4.3 Resistance to Flexure	No visible mechanical damage. Unit: mm [inch] Type / a / b / c 1608[0603] / 1.0 / 3.0 / 1.2 2012[0805] / 1.2 / 4.0 / 1.65  **Fig.5.4.2-1**	① Solder the chip to the test jig (glass epoxy board) using a eutectic solder. Then apply a force in the direction. ② Flexure: 2mm ③ Pressurizing Speed: 0.5mm/sec. ④ Keep time: 30 sec.  **Fig.5.4.2-2**
5.4.4 Vibration	No visible mechanical damage.  Glass Epoxy Board **Fig. 5.4.3-1**	① Solder the chip to the testing jig (glass epoxy board shown in Fig.6.4.3-1) using eutectic solder. ② The chip shall be subjected to a simple harmonic motion having total amplitude of 1.5mm, the frequency being varied uniformly between the approximate limits of 10 and 55 Hz. ③ The frequency range from 10 to 55 Hz and return to 10 Hz shall be traversed in approximately 1 minute. This motion shall be applied for a period of 2 hours in each 3mutually perpendicular directions (total of 6 hours)
5.4.5 Solderability	No visible mechanical damage. Wetting shall exceed 90% coverage.	① Solder temperature: 240±2℃ ② Duration: 3 sec. ③ Solder: Sn/3.0Ag/0.5Cu ④ F lux: 25% Resin and 75% ethanol in weight.

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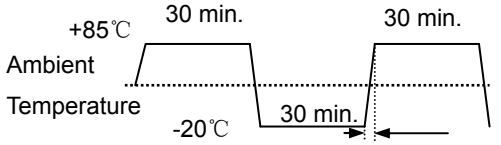
RELIABILITY AND TEST CONDITIONS

Chip Ceramic PTC Thermistor (SCP Series)

Items	Requirements	Test Methods and Remarks
5.4.6 Resistance to Soldering Heat	No visible mechanical damage. Resistance (R25) shall be within ±20% of the initial value.	① Solder temperature: 260±5℃ ② Solder: Sn/3.0Ag/0.5Cu ③ Perheat:+150 to +180℃,120+/-5s ④ Duration: ≧220℃， 60 to 90s ⑤ Reflow cycle:1 time ⑥ The chip shall be stabilized at normal condition for 1~2 hours before measuring
5.4.7 Thermal Shock		① Temperature, Time: -40℃for 30±3 min→+85℃ for 30±3min. ② Transforming interval: Max. 20 sec. ③ Tested cycle: 5 cycles ④ The chip shall be stabilized at normal condition for 1~2 hours before measuring.  Fig. 5.4.4-1
5.4.8 Resistance to Low Temperature		① Temperature: -40±3℃ ② Duration : 1000+48/-0 hrs ③ The chip shall be stabilized at normal condition for 1~2 hours before measuring.
5.4.9 Resistance to High Temperature		① Temperature: 125±3℃ ② Duration : 1000+48/-0 hrs ③ The chip shall be stabilized at normal condition for 1~2 hours before measuring.
5.4.10 Damp Heat (Steady States)		① Temperature: 60±2℃ ② Humidity: 90±5%RH ③ Duration: 1000+24/-0 hrs ④ The chip shall be stabilized at normal condition for 1~2 hours before measuring.
5.4.11 High Temperature Load		① Temperature :60±2℃ ② Duration: 1000+24/-0 hrs ③ Applied voltage: Max voltage for 1.5hs Shut Off for 0.5hrs ④ The chip shall be stabilized at normal condition for 1~2 hours before measuring.

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